

LETTER TO THE EDITOR

Statistical Inaccuracies in a Comparative Analysis of Imaging Modalities in the Assessment of Nodal Metastasis in Esophageal Cancer

Dear Sir,

In 1996, Chandawarker et al. [1] presented a very interesting work on the value of different imaging modalities for the diagnosis of lymph node metastases. To my knowledge, this is the only report that compares CT, MRI, endoscopic ultrasound, and sonography in the preoperative assessment of nodal metastases originating from esophageal cancer. However, this publication is irrelevant for future studies because of missing data and obvious statistical inaccuracies.

The usual definitions of sensitivity, specificity, and accuracy are:

$$\text{sensitivity} = \text{rp}/(\text{rp} + \text{fn}) = \text{rp}/(n * p) \quad [\text{formula 1}]$$

$$\text{specificity} = \text{rn}/(\text{rn} + \text{fp}) = \text{rn}/(n * (1 - p)) \quad [\text{formula 2}]$$

$$\text{accuracy} = (\text{rp} + \text{rn})/n \quad [\text{formula 3}]$$

Following formula 1 and 2 rp and rn may be expressed as:

$$\text{rp} = n * p * \text{sensitivity} \quad [\text{formula 1a}]$$

$$\text{rn} = n * (1 - p) * \text{specificity} \quad [\text{formula 2a}]$$

If we replace rp and rn in formula 3 by the results of formula 1a and 2a we obtain

$$\text{accuracy} = (\text{sensitivity} * p) + (\text{specificity} * (1 - p)) \quad [\text{formula 3a}]$$

Definitions:

rp = right positive cases fn = false negative cases
 rn = right negative cases n = number of patients
 fp = false positive cases p = prevalence of positive findings in n

Formula 3a demonstrates clearly that the value of accuracy has to fall between the values of sensitivity and specificity for all possible values of prevalence ($0 \leq P \leq$

1). However, there are several results reported in Tables I and II that show higher values of accuracy than those of sensitivity and specificity (e.g., endoscopic ultrasound (EUS) of lower posterior mediastinal lymph nodes: accuracy 95%, sensitivity 20%, specificity 80%). These results are obviously false and should be corrected.

Table I (cervical paraoesophageal lymph nodes): Accuracy and specificity of MRI are 94 %, but sensitivity is only 50%. This may be possible if the prevalence of malignant lymph nodes is very low. However, accuracy of CT is only 92% showing the same specificity of 94% and a higher sensitivity of 75%. I would ask the authors to discuss this conflicting data.

Tables I and II: Data on accuracy, specificity, and sensitivity are influenced by the prevalence of pathological findings. Information on the prevalence is missing in the publication and should be added to Tables I and II.

The authors state that ultrasound is the most accurate method to evaluate cervical and abdominal nodes. In Materials and Methods, however, there is no information about the criteria used to differentiate between benign and malignant lymph nodes using ultrasound.

REFERENCES

1. Chandawarker RY, Kakegawa T, Fujita H, Yamana H, Hayabuchi N: Comparative analysis of imaging modalities in the preoperative assessment of nodal metastasis in esophageal cancer. *J Surg Oncol* 1996; 61:214–217.

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